

1 CLAIMS

2 We claim:

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4 1. A method for determining near-end cross-talk effects, the method  
5 comprising:

6 inputting a test signal into at least one conductor of a transmission cable;

7 receiving a raw cross-talk signal from at least another conductor of the  
8 transmission cable; and

9 processing the raw cross-talk signal in the frequency domain to determine  
10 a combination of near-end cross-talk components thereof, said combination of  
11 components being characteristic of the near-end cross-talk effects.

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13 2. A method for determining near-end cross-talk effects according to claim 1,  
14 wherein the test signal has a frequency that is swept, each time by a predefined  
15 sweep frequency step, across a predetermined sweep frequency range, and  
16 wherein the near end cross-talk components include at least one of a cross-talk  
17 component that is non-periodic over the sweep frequency range and a cross-talk  
18 component that has a repetition period of more than a predetermined number of  
19 sweep frequency steps.

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21 3. A method for determining near-end cross-talk effects according to claim 2,  
22 wherein the combination of near end cross-talk components is obtained by  
23 averaging the raw cross-talk signal.

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25 4. A method for determining near-end cross-talk effects according to claim 3,  
26 wherein the averaging of the raw cross-talk signal is performed using the function

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$$28 \quad X1(n) = \frac{1}{2K+1} \sum_{m=-K}^{m=K} X(m+n)$$

29 wherein

30  $X1(n)$  is the averaged cross-talk signal value at a sweep frequency  $n\Delta f$ ,

31  $X(n)$  is the raw cross-talk signal value at a sweep frequency  $n\Delta f$ ,

32  $\Delta f$  is the predefined sweep frequency step,

1         $K$  is a positive integer, which corresponds to about half a predetermined  
2        number of discrete magnitude values for performing the moving average,  
3         $m$  is an integer from  $-K$  to  $K$ , and  
4         $n$  is a positive integer.

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6        5.        A method for determining near-end cross-talk effects according to claim 3,  
7        wherein the averaging of the raw cross-talk signal comprises:

8            a)        performing a moving average operation over a predetermined  
9            number of discrete magnitude values of the raw cross-talk signal to obtain  
10          an averaged cross-talk signal; and

11          b)        repeating a) on the average cross-talk signal obtained from a  
12          preceding moving average operation for a predefined number of times to  
13          obtain the combination of near end cross-talk components that is  
14          characteristic of the near-end cross-talk effects.

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16        6.        A method for determining near-end cross-talk effects according to claim 3,  
17        wherein the averaging of the raw cross-talk signal comprises:

18            a)        performing a first moving average operation over a predetermined  
19            number of discrete magnitude values of the raw cross-talk signal to obtain  
20            a first averaged cross-talk signal;

21            b)        performing a second moving average operation over the  
22            predetermined number of discrete magnitude values of the first averaged  
23            cross-talk signal to obtain a second averaged cross-talk signal; and

24            c)        performing a third moving average operation over twice the  
25            predetermined number of discrete magnitude values of the second  
26            averaged cross-talk signal to obtain the combination of near end cross-talk  
27            components that is characteristic of the near-end cross-talk effects.

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29        7.        A method for determining near-end cross-talk effects according to claim 1,  
30        wherein the test signal has a frequency that is swept between 1 megahertz and  
31        350 megahertz.

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33        8.        A method for removing near-end cross-talk effects from a raw cross-talk  
34        signal, the method comprising:

1           inputting a test signal into at least one conductor of a transmission cable;  
2           receiving the raw cross-talk signal from at least another conductor of the  
3 transmission cable;

4           processing the raw cross-talk signal in the frequency domain to determine  
5 a combination of near-end cross-talk components thereof, said combination of  
6 components being characteristic of the near-end cross-talk effects; and

7           subtracting the combination of near-end cross-talk components from the  
8 raw cross-talk signal to remove the near-end cross-talk effects.

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10       9.     A system for determining near-end cross-talk effects originating from a  
11 near-end location of the system, a near end portion of the system being  
12 connectable to a transmission cable comprising a plurality of conductors, the  
13 system comprising:

14           an injecting unit being adapted to generate and input a test signal into at  
15 least one conductor of the transmission cable;

16           a receiving unit being adapted to receive a raw cross-talk signal from at  
17 least another conductor of the transmission cable; and

18           a processing unit being adapted to process the raw cross-talk signal in the  
19 frequency domain to determine a combination of near-end cross-talk components  
20 thereof, said combination of components being characteristic of the near-end  
21 cross-talk effects.

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23       10.    A system for determining near-end cross-talk effects according to claim 9,  
24 wherein the test signal has a frequency that is swept, each time by a predefined  
25 sweep frequency step, across a predetermined sweep frequency range, and  
26 wherein the near-end cross-talk components include at least one of a cross-talk  
27 component that is non-periodic over the sweep frequency range and a cross-talk  
28 component that has a repetition period of more than a predetermined number of  
29 sweep frequency steps.

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31       11.    A system for determining near-end cross-talk effects according to claim  
32 10, wherein the processing unit is adapted to obtain the combination of near end  
33 cross-talk components by averaging the raw cross-talk signal.

1 12. A system for determining near-end cross-talk effects according to claim  
 2 11, wherein the processing unit is adapted to average the raw cross-talk signal by  
 3 using the function

$$4 \quad X1(n) = \frac{1}{2K+1} \sum_{m=-K}^{m=K} X(m+n)$$

5 wherein

6  $X1(n)$  is the averaged cross-talk signal value at a sweep frequency  $n\Delta f$ ,

7  $X(n)$  is the raw cross-talk signal value at a sweep frequency  $n\Delta f$ ,

8  $\Delta f$  is the predefined sweep frequency step,

9  $K$  is a positive integer, which corresponds to about half predetermined number of  
 10 discrete magnitude values for performing the moving average,

11  $m$  is an integer from  $-K$  to  $K$ , and

12  $n$  is a positive integer.  
 13

14 13. A system for determining near-end cross-talk effects according to claim  
 15 11, wherein the processing unit is adapted to average the raw cross-talk signal  
 16 by:

17 a) performing a moving average operation over a predetermined  
 18 number of discrete magnitude values on the raw cross-talk signal to obtain  
 19 an averaged cross-talk signal; and

20 b) repeating a) on the average cross-talk signal obtained from a  
 21 preceding moving average operation for a predefined number of times to  
 22 obtain the combination of near end cross-talk components that is  
 23 characteristic of the near-end cross-talk effects.  
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25 14. A system for determining near-end cross-talk effects according to claim  
 26 11, wherein the processing unit is adapted to average the raw cross-talk signal  
 27 by:

28 a) performing a first moving average operation over a predetermined  
 29 number of discrete magnitude values of the raw cross-talk signal to obtain  
 30 a first averaged cross-talk signal;

- b) performing a second moving average operation over the predetermined number of discrete magnitude values of the first averaged cross-talk signal to obtain a second averaged cross-talk signal; and
- c) performing a third moving average operation over twice the predetermined number of discrete magnitude values of the second averaged cross-talk signal to obtain the combination of near end cross-talk components that is characteristic of the near-end cross-talk effects.

15. A system for determining near-end cross-talk effects according to claim 9, wherein the test signal has a frequency that is swept between 1 megahertz and 350 megahertz.

16. A system for determining near-end cross-talk effects according to claim 9, wherein the receiving unit is a phase locked loop receiver.

17. A system for determining near-end cross-talk effects according to claim 9, wherein the processing unit is a microprocessor.

18. A system for determining near-end cross-talk effects according to claim 9, the system further comprises an analog to digital converting unit being adapted to digitize the raw cross-talk signal received by the receiving unit.

19. A system for determining near-end cross-talk effects according to claim 9, wherein the system is implemented in a portable testing instrument.

20. A system for determining near-end cross-talk effects according to claim 9, wherein the injecting unit, the receiving unit and the processing unit are contained within a hand held testing instrument.